



2016 Astrophysics Medium Explorer (MIDEX) & Mission of Opportunity (MO) Solicitations

Pre-Proposal Conference *CubeSats, sRLVs & Secondary Payloads*

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SCM Outline

- Overview
- Cost/Schedule Requirements, SCM classes
- Additional Requirements for SCMs
- CubeSat Investigations
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- SCMs Larger than a CubeSat
- Alternative Access to Space
- Questions



Overview

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•Three Mission of Opportunity types may be proposed in response to this PEA:

- (1) Partner Missions of Opportunity (PMOs),
- (2) New Missions using Existing Spacecraft (NMESs), and
- (3) **Small Complete Missions (SCMs).**

•**SCMs include** investigations on the International Space Station (ISS), **suborbital-class missions** (an investigation requiring flight on a high-altitude scientific balloon platform or on a **suborbital Reusable Launch Vehicle (sRLV)**, or as a **CubeSat investigation** – see Section 4.5.1 and Requirement R-10), investigations launched as **secondary payloads**, or investigations launched as **hosted payloads**.

•See Section 5.1 of the SALMON-2 AO for complete descriptions of these types of MOs, as well as constraints and requirements for proposals.



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- **2.3 The Explorers Program Office** will manage the Astrophysics Explorers Mission of Opportunity investigations under the requirements of NPR 7120.5E, *NASA Space Flight Program and Project Management Requirements*, as described in Section 4.1.2 of the SALMON-2 AO.
- **4.5.1 Cost Requirements** The PI-Managed Mission Cost is defined in Section 4.3.1 of the SALMON-2 AO.
- **Requirement R-10.** The proposed PI-Managed Mission Cost for the **Astrophysics Explorers Missions of Opportunity** shall be no more than **\$70 million in FY 2017 dollars**, except for **suborbital-class missions** (defined as (a) a high-altitude scientific balloon mission, (b) a mission on an **sRLV**, or (c) a **CubeSat mission**), for which it shall be no more than **\$35 million** in FY 2017 dollars.



Schedule Requirements

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- 4.5.2 Schedule Requirements** For Small Complete Mission (SCM) MOs, proposers must specify the launch readiness date in the proposal, which is to be no later than **December 31, 2022**.
 - Proposers should be aware that **it may be necessary** for NASA to adjust the launch date and definition phasing of selected investigations from that proposed in order to conform to the available Astrophysics Explorers Program budget profile and/or NASA's ability to negotiate a launch opportunity to the International Space Station, for a high-altitude scientific balloon mission, for **launch opportunities on reusable launch vehicles**, or for **CubeSat** launches; **therefore, the degree of launch date flexibility must be indicated in the proposal.**



4.5.3 Access to Space Cost Requirements

The following classes of platforms **are provided by NASA for access to space**, or near space, **at no cost to the PI-Managed Mission Cost** (see Section 4.6.2 and Section 4.6.3 of this PEA for additional information).

- Access to space will be provided by NASA for a mission on the International Space Station (ISS).
- NASA will provide the balloon vehicle and balloon launch services for a mission on a high-altitude scientific balloon.
- The platform is provided by NASA to host a payload on an **sRLV**.
- NASA will provide launch and deployment services for a **CubeSat** mission.



4.5.3 Access to Space Cost Requirements

NASA provides launch and deployment services for missions on CubeSats that utilize the CubeSat Launch Initiative (CSLI) at no cost to the PI-managed Mission Cost.

For SCMs larger than a CubeSat that require launch and deployment from an Expendable Launch Vehicle (ELV), the proposal must specify whether the access to space is to be provided by NASA, for which a charge against the PI-Managed Mission Cost must be included, or secured by the PI.

The charge for NASA-provided access to space varies by size and whether a dedicated launch is required; see the **Launch Services Program Small Payload Access to Space Catalog in the Program Library**. If the PI secures access to space, including as a hosted payload, any costs for access to space must be included in the PI-Managed Mission Cost.

LSP Small Payload Access to Space Catalog

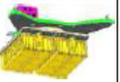
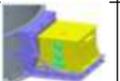
Charge to PI-Managed Mission Cost	Volume (interface)	Payload Max Launch Mass	Orbits	Availability of Opportunities (H/M/L)	Launch Vehicles	LV Risk	Comments
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Cubesats

1U		no charge	10x10x11.35 cm	**1.33 kg	<div style="display: flex; align-items: center;"> <div style="font-size: 3em; margin-right: 10px;">}</div> <div> <p>400km @ 51.6deg circ for ISS deploy</p> <p>multiple for others</p> </div> </div>	High	ISS (Dragon/Cygnus)	G	Certified; For low risk-tolerant payload 1st launches 2017/2018
3U		no charge	12 x 12 x 36 cm	**5 kg		Med	Atlas V / Falcon 9	G	
6U		no charge	12 x 24 x 36 cm	**12 kg		Med	Venture Class	R	

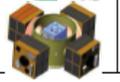
**At the cost of flexibility in manifesting/integration, violation of these mass limits may be allowed. Contact the LSP POC listed below.

Small Sat / Cubesat Constellations

Surf Board		\$3.0M	*two 3U dispensers *two 6U dispensers	50 kg	multiple	Low	Falcon 9	G	Certified; For low risk-tolerant payload
Aft Bulkhead Carrier		\$3.0M	*51x51x ~87 cm smallsat or cubesat dispensers	80 kg	multiple	Low	Atlas V	G	Certified; For low risk-tolerant payload (future "CubeSat Express" design may hold up to 200lb of CubeSats - currently at PDR level)
C-Adapter Platform		\$3.0M	*23 x 31 x 33 cm smallsat	45 kg	multiple	Low	Atlas V / DeltaIV	G	Certified; For low risk-tolerant payload

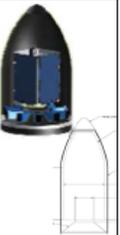
* see provider websites for updated interface details

ESPA Class Secondaries

ESPA/ SHERPA		\$10M	*61 x 71 x 97 cm (38cm clampband or sep system)	*six ports 180 kg each	multiple	Medium	Falcon/Atlas	G	Certified; For low risk-tolerant payload
ESPA Grande		\$10M	*81 x 106 x 97cm (61cm clampband or sep system)	*four or five ports (300 kg each)					

* see provider websites for updated interface details

Primaries

VCLS Class		\$15M	1.1m dia (smaller dia above 0.6m height)	150 kg	RL: 500km SS to 45 deg FF: 425km LEO 33-98 deg VG: 500km SS	Medium	 RocketLab Electron  Firefly Alpha  Virgin Galactic	R	Awaiting 1st launch; No LSP Certification planned; For high risk-tolerant payload
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Additional Requirements for SCMs

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4.6.3 Additional Requirements for Small Complete Mission of Opportunity Investigations

The following requirements are in addition to those in Section 5.1.3 of the SALMON-2 AO.

Requirement R-20.

In addition to the requirements given in the SALMON-2 AO, all proposed SCM investigations, with the exception of investigations requiring flight on the ISS, suborbital-class missions, or NASA-provided launch vehicles (see Section 4.6.3.5), must also provide a Letter of Commitment from the program or agency providing access to space.

This Letter of Commitment must contain: (1) a detailed description of the proposed provisions for access to space (e. g., launch to orbit provided by industrial or non-U.S. partner, secondary ride on another U.S. sponsored mission, etc.), and (2) the status of those proposed flight provisions within the sponsoring program or agency (i.e., conditional, confirmed, conceptual, etc.) including the level of commitment that the sponsoring program/ agency has made to support that flight opportunity.



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4.6.3.3 Investigations as a CubeSat

A SCM may be proposed for flight as a **CubeSat**. NASA has a **CubeSat Launch Initiative (CSLI)** and regularly provides **launch opportunities for CubeSats** as secondary payloads on U.S. Government missions. The CubeSat Launch Initiative (CSLI) is managed by the NASA Human Exploration and Operations Mission Directorate. See http://www.nasa.gov/directorates/heo/home/CubeSats_initiative.html. For CubeSat proposals, all instruments/small satellites are recommended to **comply with Cal Poly CubeSat Developer's specifications**, found at <http://www.cubesat.org/resources/>. Concepts that do not comply with the Cal Poly CubeSat and Poly Picosat Orbital Deployer (P-POD) standards should clearly describe how their designs are packaged and deployed. NASA Launch Services Program has issued a **Program Level Dispenser and CubeSat Requirements Document** with requirements for CubeSats sized up to 6U (2U x 3U).



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All proposals for CubeSats sized up to 6U shall be compliant with these requirements. These documents can also be found in the **Program Library**. No CubeSat form factors larger than 6U will be considered under the present solicitation. Qualifying CubeSat form factors (size) include 1U, 1.5U, 2U, 3U, and 6U. Refer to the **LSP Small Payload Access to Space Catalog** in the Program library for the mass limitations. **No CubeSat form factors larger than 6U will be considered under the present solicitation.**

For further information on CubeSats, please contact:

Anne E. Sweet

Launch Services Program Executive

Phone: 202-358-3784

E-mail: anne.sweet-1@nasa.gov

or

Jason C. Crusan

Director, Advanced Exploration Systems

Phone: 202-358-0635

E-mail: jason.crusan@nasa.gov



sRLVs

4.6.3.4 Investigations on suborbital Reusable Launch Vehicles

SCMs may be proposed for flight on **suborbital Reusable Launch Vehicles (sRLVs)**.

Access to sRLV platforms is managed by the **Flight Opportunities Program** within the Space Technology Mission Directorate. Information about sRLVs is available from the Flight Opportunities Program website at <http://flightopportunities.nasa.gov>. Additional information on sRLV vehicles, including general vehicle capabilities and contact information for some vendors, is available at <http://flightopportunities.nasa.gov/platforms>. The Flight Opportunities **Program may advise proposers** on the use of sRLV platforms, including the potential integration, safety and mission assurance, and operational costs.

Proposers interested in using sRLVs **must identify a vehicle** that can provide the technical capabilities required to conduct the proposed investigation.



sRLVs

- Proposals for investigations using sRLVs as platforms must specify the technical requirements that their investigation places on the vehicle.
- SCMs to be flown on sRLVs must either be automated or remotely operated. Remote operation capability must be confirmed with the flight operator.
- The proposal must include a Letter of Endorsement from a commercial vendor that:
 - (i) provides technical information on how the vehicle will meet the investigation requirements,
 - (ii) states that the vehicle will be available for use at the time proposed for flight and provides information showing a plan for getting from the current vehicle status to flight status, and
 - (iii) provides a quoted cost for the flight and all other services that are required from the vehicle vendor to enable and conduct the proposed investigation.
- The Flight Opportunities Program is available to assist with (i) – (iii).



sRLVs

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- The Flight Opportunities Program may advise proposers on the use of sRLV platforms, including the potential integration, safety and mission assurance, and operational costs.
- Questions concerning potential sRLV investigations may be addressed to:

Robert Yang

Flight Opportunities
Space Technology Mission Directorate
NASA Headquarters
Washington, DC 20546
Telephone: 202-358-0143
E-mail: robert.l.yang@nasa.gov



- **SCMs larger than CubeSats** may be proposed for flight on an ELV. The **proposal must specify** whether the access to space is to be provided by NASA, for which a charge against the PI-Managed Mission Cost must be included, or secured by the PI.
- Accommodations on NASA-provided access to space could come in various forms, including as a secondary payload on an Evolved Expendable Launch Vehicle (EELV) Secondary Payload Adapter **(ESPA) ring, ESPA Grande, Aft Bulkhead Carrier (ABC), and C-Adapter Platform (CAP), or as a primary payload** utilizing Venture Class Launch Services. **Compatibility to multiple platforms is encouraged** to provide flexibility in manifesting. For additional information on the applicable platforms and charges to the PI-Managed Mission Cost for this solicitation, see the **Launch Services Program Small Payload Access to Space Catalog** in the Program Library.



4.6.2 Alternative Access to Space

If access to space is not provided in the applicable PEA, proposals may include alternative access to space through provision of non-NASA launch services as a secondary, co-manifested, or hosted payload. Alternative access to space may be either purchased or contributed.

Alternative access to space may include spacecraft or payload accommodations on a U.S.- or foreign-manufactured spacecraft launching on a U.S.- or foreign-manufactured launch vehicle.

Access to space for NASA payloads is governed by the U.S. Space Transportation Policy (<http://www.whitehouse.gov/sites/default/files/microsites/ostp/space-transportation-policy-2005.pdf>).



4.6.3 SALMON-2 AO Coordination with NASA for Rideshare Opportunities

Proposers considering the **use of non-NASA launch services** as a secondary, co-manifested, or hosted payload **should contact the NASA Launch Services Program (LSP)** for potential rideshare opportunities and **details associated with LSP providing advisory services** for launch mission assurance for missions flying as primary or secondary payloads on U.S. or foreign launch vehicles per NPD 8610.7D and NPD 8610.23C, *Launch Vehicle Technical Oversight Policy*.

The LSP point-of-contact for potential rideshare opportunities is

Mr. Garrett Skrobot

(321) 867-5365 or by

E-mail: garrett.l.skrobot@nasa.gov.



Questions?



**All further questions pertaining to the MIDEX AO or PEA R
MUST
be addressed to:**

**Dr. Wilton Sanders
Astrophysics Explorers Program Scientist
Science Mission Directorate
NASA Headquarters
Washington, DC 20546
wilton.t.sanders@nasa.gov**

**(subject line to read "MIDEX AO or PEA R as applicable")
202.358.1319**
